higher. At length roused by the nearer approach of danger, he looked around him, but in vain. As the waters advanced he retreated, wringing his hands in all the agonies of despair, and at length hung clinging to the summit of the rock, expecting every moment the approach of that wave which was to cover him for ever, and gazing with fixed and haggard eyes, on his friend who was now at a distance, steering his course in safety through the ocean.

Corso could no longer restrain himself. And while his eyes were still fixed on the wondrous scene before him. "Thanks, venerable sage," he exclaimed, "for this, thy lesson; but say will that provident mariner reach the country to which he how directs his course, or are his senses mocked by a vain delusion?" He paused for an answer, and on receiving none, turned round to repeat his question, but the old man was gone; and on recurring to the scene he had just now quitted, it had vanished, and he found himself again standing at the entrance of the cave. He remained a few moments wrapt in speechless meditation: then turning to the sun, which now began to beam in full splendor above the horizon, poured forth his tribute of thankful gratitude to that Being who had deigned to illuminate his soul, and thoughtfully bent his steps homewards, fully convinced that the only business of man in this life is to prepare for another.

For the Belfast Monthly Magazine.

ON COMBUSTION.

COMBUSTION signifies a burning, or in other words, the decomposition of certain substances called combustibles, accompanied with light and heat. The process of combustion, like various other operations of nature, although subject to our daily examination, yet very few are able to give a rational explanation of it.

The various phenomena it exhibits, its astonishing effects, its infinite uses, and its devastations, have rendered it in all ages a principal object of human attention. The whole extent of civil economy, as well as of almost all the articles of necessity and of luxury, most of the arts of more essential service to mankind, such as the manufacturing of metals, of glass, pharmacy, &c. depend almost entirely on combustion. By means of it the inclemencies of the seasons, and the dismal darkness of night are in a great measure removed. The most active instruments of destruction, the greatest scenes of wonder, admiration, and terror, such as the conflagration of towns, the discharge of artillery, the eruptions of volcanoes, are those in which combustion is the sole actor.

Whilst the wants and economy of mankind, have at all times called forth their industry in devising easy methods of lighting and warming their apartments, of preparing their victuals, &c. the calm contemplations of the philosopher have endeavoured to investigate the cause or causes of this wonderful phenomenon. It is natural to suppose that their first ideas must have been extremely incoherent and fanciful; since the present theory, which rests upon the foundation of innumerable experiments and strict reasoning, is vastly different from any sort of hypothesis, that even the wisest philosopher would have been led to form without the light of those experiments.

The first plausible theory was formed by STAHL, an eminent writer. The striking difference between bodies combustible and incombustible, induced him to suppose that the combustibles were endowed with a peculiar principle of inflammability, which the incombustibles had not, and to this supposed principle he gave the name of *phlogiston*. According to this suppo-

sition, when combustibles were heated to a certain degree, they began to part with their phlogiston, and continued to burn as long as they had phlogiston to lose; after which, they remained in a state of incombustibility; hence in the former state, those bodies were said to be phlogisticated, and in the latter they were said to be dephlogisticated.

With certain bodies, the combustion was attended with a separation of other components, so that afterwards they could not be brought back to their former state by the mere addition of phlogiston; but with other bodies, as for instance, the metals, the processes of dephlogistication and phlogistication might be repeated without end. This plausible theory was no sooner made known, than it was eagerly adopted by philosophers, so that for a long period it remained the most prevailing theory of combustion. But though the theory was universally adopted, the existence of the principle upon which it was established, could not be proved. There was no exhibiting the phlogiston by itself; and it was merely a supposition that a body acquired or lost its inflammability, according as it was combined with, or deprived of, its phlogiston. A supposition which, on a closer examination of facts, was found inadequate to the explanation of the concomitant phenomena. For instance, when a piece of zinc (and such was also the case with other combustibles, as far as they might be subjected to experiments) of a determinate weight, was burnt and reduced to a calx, the weight of the calx was found to exceed the original weight of the zinc. It was, therefore, evident, that it had acquired something ponderous, and this was utterly repugnant to the phlogistic theory, for by the loss of phlogiston it ought rather to have lost part of its original weight. In answer to this, a strange idea was suggested, namely, that the phlogiston was a principle of lightness; so that bodies became lighter by the addition of phlogiston, and *vice versa*. But this supposition, so singular and so repugnant to the general laws of gravitation, was soon abandoned by philosophers, when a variety of decisive experiments, the concurrence of recent discoveries in other branches of philosophy, and a strict mode of reasoning, introduced a new theory, which is both supported by accurate experiments, and sufficient to account for the phenomena. One of the principal labourers in the investigation, and full establishment of this new and rational theory, was the ingenious, but unfortunate Lavoisier, to whose genius and persevering industry, the scientific world must ever think itself indebted.

In order to render this ingenious theory more easily understood by our readers, we shall lay before them the following experiments. Take a glass vessel of a cylindrical form, having a stoppel capable of excluding the entrance or exit of any air, and let the outside of this vessel be graduated, so as to divide its capacity into pretty small portions. Put into this vessel, full of common air, a piece of dry phosphorus of a determinate weight; close the vessel tight, and heat gradually that part of it in which the piece of phosphorus stands by means of the flame of a candle. As soon as the phosphorus has been heated to a certain degree, it takes fire of itself, burning with a flame and thick white smoke; but it soon ceases to burn. Suffer the vessel to cool, and the smoke will fall in the form of flakes, if the vessel and the air contained in it were quite dry, otherwise the flakes will melt in the moisture. If, in this experiment, the vessel be weighed before, and after combustion, it will be found precisely of the same weight.

When the vessel is cooled to the actual temperature of the atmosphere, plunge the aperture of it under water,

and in that situation remove the stopple: you will find that the water rises in it, which shows that a portion of the air has been destroyed or absorbed; in short it has disappeared. By measuring the height of the water risen within the vessel, which is indicated by the graduation on the outside; in general, it will be found that one quarter of the original quantity has disappeared, and the remaining air will be found unfit for the combustion of phosphorus, or of any other combustible; and likewise unfit for the respiration of animals, so that if a bird, a mouse, or any other animal be confined in it, death will soon ensue. If the water which has rushed into the vessel be examined, it will be found to have contracted a sour taste indicating that an acid has been generated.

This is the acid of phosphorus; and if the vessel be opened in quick-silver, instead of water, the flakes, which in the preceding experiment were dissolved in the water, will now be found in the form of flakes on the surface of the quick-silver, and if carefully gathered and weighed, will be found together with the remaining phosphorus (if any part remains unburnt) equal to the weight of the original quantity of phosphorus, together with the weight of the ore that has disappeared. Hence it is evident that the whole process of combustion consists in a decomposition of part of the atmospherical air. This part of it is about a quarter of the whole, and its base is absorbed by the combustible body, and generally communicates to it acid properties, in consequence of which it has been called *oxygen gas*; from the Greek, meaning the acidifying principle. Therefore, in combustion, the decomposition of the oxygen gas is affected by the burning body, when this body has been heated to a certain degree, which degree varies with the nature of the body; whilst the base of oxygen gas is absorbed and fixed by the burning body, which has thereby increased its weight, and changed its nature; the *caloric* being disengaged, passes off in the state of sensible heat, and sometimes with such a portion of light as gives the appearance of red or white heat.

Acids in general are formed from the absorption of oxygen during combustion. When the combustion is accompanied with red heat, but not with flame, it is called *ignition*. But ignition may also be applied to incombustible substances, for these may be rendered red or white hot, without suffering any decomposition. When a vapour arising from the heated body burns over it, it is then called *inflammation*, and when the inflammation is rapid and attended with noise, it is called *detonation*. Having now compendiously stated the new theory of combustion, it will, perhaps, be necessary to add a few remarks respecting several parts of it, which could not be intermixed with the theory without rendering it confused.

In the first place, since the process of combustion consists in the decomposition of oxygen gas, the generalizing spirit of modern philosophy includes every process in which oxygen gas is decomposed, under the name of combustion: thus, animal respiration, in which this gas is decomposed, its base absorbed, and heat evolved, may be reckoned amongst the processes of slow combustion. The gradual absorption of oxygen by metallic bodies may also be reckoned amongst those processes, and innumerable others, which will easily occur to the mind of every reader accustomed to reflect on the various operations of nature. Since combustion consists in a decomposition of oxygen gas, it follows that without oxygen no combustion can take place.

The oxygen, however, may be contained in other substances, in consequence of which those substances become capable of assisting combustion.

Now there are seven of those substances, which from their containing oxygen, are called supporters of combustion; and these are oxygen gas, atmospheric air, nitrous oxyd, nitric oxyd, nitric acid, oxyginized muriatic acid, and hyperoxyginized acid, (the nature of which substances we shall endeavour to explain in a future number, under the general term Gas.) From what has been said, it follows, that with a given combustible, the quickness of the decomposition is in proportion to the supply of oxygen, which shows the reason why a fire is increased by blowing common air upon it, and much more by blowing upon it oxygen gas. But *cæteris paribus* with different combustibles; the fire is strongest when the combustible body has the srongest attraction for oxygen. The flame of hydrogen gas urged by oxygen gas is reckoned to produce the most intense heat.

With certain combustible bodies, a peculiar process takes place. It is a remarkably slow process of spontaneous combustion. The body, by attracting oxygen from the atmosphere, becomes thereby gently heated, in consequence of which it is capable of uniting with oxygen; a greater decomposition of the latter ensues, more heat is evolved, and thus the process is gradually accelerated, until flame and visible combustion takes place. Such is sometimes the case with hay and many other substances. The well known mixture of iron filings and sulphur moistened with a little water is an instance of this sort; for if this mixture be buried a little below the surface of the earth, it will of itself, after the lapse of several hours, burst forth into a state of ignition. This experiment has been generally called the artificial volcano.

Though heat is derived, in combustion, from the oxygen gas, the derivation of light is not so evident. It has been for a long time supposed that this element is also one of the components of oxygen gas; but the observations made respecting the light yielded by several bodies when they are slightly heated, or even spontaneously, and that some of them yield much more light than others, seem to prove that light forms a component principle of most bodies, and that it is evolved from the combustible. It is likely, however, that part of it at least may be derived from oxygen gas. G.

To the Editor of the Belfast Magazine.

SIR,

PRESUMING it may come within the scope of the intended plan of your Magazine to disseminate knowledge of the arts and manufactures, and to encourage inquiries concerning them, and thus draw out information which may be extensively useful, I request to be informed by some one, who may possess the competent knowledge, if any marking-ink has been discovered for linens or calicoes, which will stand the operation of the oxy-muriatic acid, in the new process of bleaching; as the common marking-ink hitherto in use, composed of lunar caustic, [nitrat of silver] dissolved in water, is found not to bear the operation of the new mode, unless the mark be covered with lard, soap, or some oily matter, during the immersion of the piece in the steep, which mode is found very troublesome in practice. I have heard that such a marking-ink as I am inquiring after is in use in Scotland, and to persons acquainted with the modes of bleaching practised in that country, I particularly direct my inquiry.

A LINENDRAPE

To the Editor of the Belfast Magazine.

SIR,

I WILL be much obliged to any of your readers who are conversant